EFFECTS OF THE PERSONAL FITNESS MERIT BADGE ON CARDIO-METABOLIC RISK, HEALTH-RELATED FITNESS, AND PHYSICAL ACTIVITY IN ADOLESCENT BOYS

by

Justin D. Maxwell

A thesis submitted to the faculty of the
The University of Utah
in partial fulfillment of the requirements of the degree of

Master of Science

Department of Exercise and Sport Science

The University of Utah

December 2016

UNIVERSITY OF UTAH

STATEMENT OF THESIS APPROVAL

The thesis of **Justin D. Maxwell**

has been approved by the following supervisory committee members:

Timothy Brusseau	, Chair	**9/9/2016**
		Date Approved
Ryan Burns	, Member	**9/12/2016**
		Date Approved
Hester Henderson	, Member	**9/12/2016**
		Date Approved

and by **Timothy Brusseau** , Chair/Dean of

the Department/College/School of **Exercise and Sport Science**

and by David B. Kieda, Dean of The Graduate School.

ABSTRACT

A growing number of adolescents are more sedentary and are having fewer formal opportunities, such as physical education, to participate in physical activity. With the mounting evidence that sedentary time has a negative impact on cardio-metabolic profiles, health-related fitness, and physical activity, the need to find an affordable adolescent physical activity intervention that adolescents will participate in is paramount. The purpose of this research study was to evaluate the effect of the Personal Fitness merit badge system on physical activity, health-related fitness, and cardio-metabolic blood profiles in Boy Scouts aged 11-17 years. Fourteen Boy Scouts from the Great Salt Lake Council of the Boy Scouts of America earned their Personal Fitness merit badge. The research staff hosted one merit badge class held at a local church building in the Salt Lake Valley. At the classes, boys received the information needed to obtain the merit badge. They also had cardio-metabolic profiles taken using the Cholestech LDX analyzer, performed health-related fitness testing, and received a pedometer to measure free-living physical activity for 1 week. The boys completed the merit badge over 12 weeks and returned to a final class to again be tested on the aforementioned measures. Results from the related-samples Wilcoxon signed rank test showed that the median of differences between VO2 peak pretest and posttest scores were statistically significant (p=0.004). However, it also showed that the differences between the Pre-MetS and Post-MetS scores (p=0.917), average steps taken per day (p=0.317), and BMI (p=0.419) were not statistically significant. In conclusion, the merit badge had an impact on

cardiovascular endurance of the boys who earn the merit badge, suggesting this program has potential to improve cardiovascular fitness and should be considered for boys participating in the Boy Scouts.

CONTENTS

INTRODUCTION

In 2013, the Center for Disease Control and Prevention (CDC) reported that 15% of the United States adolescent population did not participate in at least 60 minutes of physical activity on any day of the week, that 33% watched television for 3 or more hours per school day, and that 41% used computers for 3 or more hours per school day. Additionally, 52% of children and adolescents did not attend physical education (PE) classes in an average school week (CDC, 2013). These increases in sedentary time and decreases in physical activity opportunities should be alarming for adolescents because sedentary time has been associated with disease risk indicators such as obesity and cardio-metabolic health markers (Dunstan D.W., Howard, B., Healy, G.N., & Owen, N., 2012; Vaisto et al., 2014). It has been shown that poor metabolic scores may translate from adolescence to adulthood, which in turn increases the incidence of cardio-metabolic disease and early mortality (Andersen & Haraldsdotter, 1993; Eisenmann, J.C., Welk, G.J., Ihemls, M., & Dollman, J., 2007; Katzmaryk et al., 2001).

The question then becomes what can be done to improve the downward trend of physical activity? Obesity and overweight has been shown to be the most important modifiable factor in diabetes prevalence, thus decreasing the occurrence of obesity and overweight becomes an important intervention in the prevention of diabetes (Menke, A., Rust, K.F., Fradkin, J., Cheng, Y.J., & Cowie, C.C., 2014). It was found that Canadians have much lower diabetes prevalence than Americans; one reason for this was that physical activity levels were higher in Canada than they were in the United States (Zhang

et al., 2010). Those who were more sedentary had worse cardio-metabolic profiles when compared to those who were more active (Dunstan et al., 2012). Thus, the need to find an effective, cost-efficient physical activity intervention in adolescences that decreases sedentary time is vital to the health of a growing number of American youth.

Many physical activity interventions targeting adolescents have been implemented and evaluated. Alberga et al. (2013) evaluated 50 interventions and created a list of 10 practical ideas that will likely help improve the success of physical activity intervention. Physical activity setting is important, choice of trainer matters, physical activity should be varied and fun, parents-guardians should be included, individual physical and psychosocial characteristics should be accounted for, realistic goals should be set, regular reminders are important, multidisciplinary approach should be used, barriers should be identified early along with plans to overcome them, and participants should be told what is in it for them. It has also been noted that the longer the intervention lasts, the greater the health benefits and the higher the adherence to physical activity practices (Sun et al., 2013).

The Middle School Physical Activity and Nutrition (M-SPAN) intervention targeted middle school campuses before, during, and after school hours (Sallis et al., 2003). The goal was to change physical activity behaviors of the middle school students. To accomplish this task, the research staff aimed a portion of their intervention at physical educators, community leaders and members, school leaders, parents, and school policies (Hoefer, McKenzie, Sallis, Marshall, & Conway, 2001; Mckenzie, 2000; McKenzie, 2001; McKenzie, 2004; McKenzie, Marshall, Sallis, & Conway, 2000; Moody et al., 2004; Sallis et al., 2001; Strelow et al., 2002). The intervention is regarded

as one of the most successful school- and community-based adolescent interventions (Sparkpe, 2015). Physical education classes increased moderate to vigorous physical activity (MVPA) levels by 3 minutes per class (Mckenzie, 2000) and the students in the classes were active for 52% of the class time, a 4% increase (Mckenzie, 2004). These small improvements helped significantly decrease the BMI of the participating boys (Sallis et al., 2003).

A 12-week study examined an after-school program for boys and girls ages 5-12 delivered by YMCA counselors. The program was created by an experienced team of scholars who have vast experience with health behavior changes. Three days per week, a 45-minutes class was held at the YMCA. Cardiovascular activities (e.g., jump roping, relay runs, adapted sport games, etc.) were used on all 3 days of the week; resistance exercises (e.g., resistance bands, other exercises intended to strengthen major muscle groups) were utilized 2 out of the 3 days a week, and behavioral skill training (i.e., brief lessons on self-management and self-regulatory topics) was implemented once per week. The researchers found that this program could be used as an adequate replacement for the reductions of physical education in the school, probably because they found that by participating in the program, the participants had a significant reduction in percent body fat (Annesi, J.J, Westcott, W.L., Faigenbaum, A.D., & Unruh, J.L., 2005).

Jago and Baranowski (2004) reviewed noncurricular interventions such as during school breaks, active travel, extracurricular activities, and summer day camps for promoting physical activity. They found that, in general, these interventions showed limited success. Many of the interventions failed to increase physical activity, reduce BMI, or change physical activity behaviors. It was suggested by the researchers that these

interventions could have been improved if they had actively involved parents, focused on setting appropriate goals, advertised the interventions to the potential participants more effectively, and exposed the participants to the intervention for a longer period of time. The interventions that the researchers in this study found to be successful saw increases in habitual physical activity, short-term reduction in weight, and long-term weight control.

The Boy Scouts of America (BSA) is a values-based organization that focuses on the development of youth character through a variety of avenues, including personal fitness (BSA, 2015). The typical ages for boys participating in the scouting program are ages 11 to 17. The biggest accomplishment for a Boy Scout is to earn their Eagle Scout award. This task takes years to accomplish and requires the dedication of each scout to earn all the badges required. The Personal Fitness merit badge is one of 12 merit badges required to earn the Eagle Scout award. In 2013, there were 888,947 Boy Scouts in the United States; 56,841 earned their Eagle Scout award and 56,295 of them earned their Personal Fitness merit badge, making it the ninth most common merit badge earned by Boy Scouts (BSA, 2015). To date, there have only been two studies published that have used the Boy Scouts as participants in physical activity interventions.

The first study examined the effects of a physical activity intervention using troop time and an online program targeting self-efficacy and preference change (Jago, Baranowski, et al., 2006). The research team was given 20 minutes of troop time to lead a physical activity session focused on earning what the researchers called the “Fit for Life” badge; scouts were encouraged to take what they learned in this session and use it in their daily lives. The activity sessions had a cognitive component (teaching about an

activity, healthy habit, or safety guidelines) and a psychomotor component (opportunities to practice/play games that could be used outside of their troop meetings). Activities included stretching for basketball, ultimate football, strengthening for football, and basketball knockout. Then, two times before the next troop meeting 1 week later, scouts were asked to login to the online program and set goals and then report back on the goals. To measure if the intervention had an effect on body composition (BMI and skin fold thickness) and physical activity (scouts wore an accelerometer for 3 consecutive days), pretest and posttest measurements were taken. Although the intervention did not yield a significant increase in minutes of moderate to vigorous physical activity (MVPA), there was a trend toward decreasing sedentary time.

Another study involving Boy Scouts evaluated the relationship between goal setting and physical activity behavior change (Latif et al., 2011). The Boy Scouts would login to a program each week and set PA goals. Later that week, they would again login and state whether they had completed that goal. To monitor physical activity levels, an accelerometer was worn for 3 consecutive days. The results showed that physical activity goals of the Boy Scouts did not relate to physical activity because the activity levels as measured by the accelerometer did not have significant change (Latif et al., 2011). The research team of Seger, Eccles, and Richardson (2008) recommended that future goals should focus on outcomes to be achieved from physical activities goals, as this has been shown to help relate goal setting to physical activity behavior change. The results from the aforementioned interventions have shown that both in school and out of school programs can have a positive impact on the fitness and health of adolescents participating in them. However, many of the interventions did not change physical activity levels,

increase health-related fitness, nor did they improve cardio-metabolic profiles. The purpose of this research study was to evaluate the effects of the Personal Fitness merit badge system on physical activity, health-related fitness, and cardio-metabolic blood profiles in Boy Scouts aged 11-17 years.

R1: What effects will the Physical Fitness merit badge have on the physical activity levels of Boy Scouts?

H1: Boy Scouts' physical activity levels as measured with the pedometer will show a significant increase following the earning of the Physical Fitness merit badge

R2: What effects will the Physical Fitness merit badge have on health-related fitness levels of the Boy Scouts?

H2: Boy Scouts' health-related fitness levels for cardiovascular endurance as measured by the PACER will show a significant increase in laps following the earning of the Physical Fitness merit badge.

R3: What effects will the Physical Fitness merit badge have on the cardio-metabolic profiles of Boy Scouts?

H3: Boy Scouts' cardio-metabolic profiles will become more healthy as measured by a significant reduction in BMI, LDL, total cholesterol, waist circumference, fasting blood glucose, and blood pressure along with significant increases in HDL.

Study Significance

This study will help identify the strength of the Personal Fitness merit badge as a physical activity intervention. Thousands of boys earn the merit badge each year and its benefits are not yet known. The Boy Scouts of America can use the results of this study to see how effective the merit badge is at helping scouts develop healthy habits. It has

the potential to show strengths and weaknesses of the badge and provide ideas for ways to improve. The merit badge has the potential to be used outside of the Boy Scouts of America. It could be used in physical education settings, gym settings, and even pediatric settings. For example, the merit badge could be used as a semester-long project in a physical education class.

Definition of Terms

- Body Mass Index= BMI
- High-Density Lipoprotein= HDL
- Low-Density Lipoprotein= LDL
- Stadiometer= instrument used to measure height

METHODS

Participants

A convenience sample of 14 Boy Scouts ages 11 to 17 years old (M=11.93, SD=1.21) from the Great Salt Lake Council of the Boy Scouts of America (Salt Lake County, Utah) participated in a Personal Fitness merit badge class. The class was held at a local LDS church building in South Salt Lake City. Boys came from the surrounding areas, including South Salt Lake, Murray, and Holladay. Boys who participated could not have earned the merit badge previously.

Personal Fitness Merit Badge

The Personal Fitness merit badge is one of 12 merit badges required to earn the Eagle Scout award. In order to earn the merit badge, scouts are required to complete nine intensive steps to improve areas of personal fitness. At the completion of the merit badge, each scout will have performed the following:

- Visit a pediatrician or family practice doctor to have a physical
- Provide a detailed definition of and explain the importance of:
    - Mental health
    - Physical health
    - Social health
    - Physical fitness
    - Nutrition

- Identify and learn the importance of the scout's:
    - Weight and body composition
    - Healthy and nonhealthy habits
    - Appropriate and inappropriate diets
    - Vaccination needs
    - Sleep schedule
    - Physical activity and exercise routines
    - Family life
    - Disease potential
- Perform pre- and posttest measurements for aerobic fitness (mile run), strength (pushups and curl-ups), flexibility (sit and reach), and body composition (BMI).
- Create, perform, and log a 12-week physical fitness program
- Find out about three careers that specifically deal with personal fitness

Instruments

Physical activity measurement. To objectively review the physical activity levels of the participants, a Digiwalker CW600 pedometer will be utilized. The Digiwalker CW600 has been found to provide a valid measure of physical activity in adolescents (Jago et al., 2006). As the scout left the merit badge class, they were given a pedometer to wear for 6 consecutive days, from the time they wake up until they go to bed, starting the next day.

Cardio-metabolic health markers. The cardio-metabolic profile of each participant was collected using the Cholestech LDX system (Alere Inc., Waltham, MA, USA). The system included measures for total cholesterol (TC), LDL cholesterol, HDL

cholesterol, triglycerides (TRI), and blood glucose (BG). The blood sample was collected in a fasting state on the day of the merit badge class. Both the participant and the parent or guardian was asked for verification of the fasting state. Blood samples were collected with a single prick to the scout's right index finger using a 40-uL capillary tube and immediately injected into the Lipid Profile-Glucose Cassette (Alere Inc., Waltham, MA, USA) and subsequently analyzed. The finger was cleansed and bandaged and all materials were properly disposed of in a biohazard container.

Blood pressure measures were identified by using the electronic blood pressure machine the CONTEC08A (Contec Medical Systems Co.; Qinhuangdao, China). To ensure a resting measure, scouts had their blood pressure measured prior to performing any fitness testing. Blood pressure standards in adolescences are dependent upon age, sex, and height and are found in standardized charts (National Heart, Lung, and Blood Institute, 2004; Riley & Bluhm, 2012). Prehypertension in adolescence is defined as having a blood pressure between the 90^{th} percentile and the 95^{th} percentile or having a measure of 120/80 mm HG or greater. Hypertension is defined as having a blood pressure measure greater than the 95^{th} percentile (Riley & Bluhm, 2012).

Body composition measurement. The Body Mass Index (BMI) of the participants was used to measure body composition. BMI was found by taking the scout's weight in kilograms divided by the square root of his height in meters. Height was measured to the nearest 0.01 meter using a portable stadiometer (Seca 213; Hanover, MD, USA). Weight was measured to the nearest 0.1 kilogram using a portable medical scale (BD-590; Tokyo, Japan).

Waist circumference was measured to the nearest 1cm using a standard tape measure. Height, weight, and waist circumference measures were collected in a private room. Shoes were removed, but the clothes remained on for all three measures.

Aerobic fitness. Aerobic fitness was measured through the completion of the FITNESSGRAM Progressive Aerobic Cardiovascular Endurance Run (PACER). Participants completed as many PACER laps as possible. Scores were recorded to the nearest lap. The running took place inside of a gymnasium with hard wood flooring.

The fitness testing and cardio-metabolic profiles for the pretest were collected on the day of the first merit badge class. Posttest data were collected 12-weeks later at the last merit badge class. The reason we did not use pushups, sit-ups, and sit and reach as dependent variables was because those tests have been shown to not have as strong of a relationship to health.

Procedures

The Great Salt Lake Council notified scout troops via email and face-to-face meetings to ensure that each individual scout troop was aware of the day of the class. Scouts' wishing to earn their Personal Fitness merit badge were asked be a part of the intervention group.

Boys that did not want to earn their Personal Fitness merit badge, but who wished to receive a free health screening, which includes health related-fitness scores, blood pressure, BMI, waist circumference, blood lipid levels, and physical activity levels, participated in the control group. They too attended the merit badge class to receive the screening; however, they did not receive any information about nor did they work on the personal fitness merit badge.

The first class introduced the participant's to the Personal Fitness merit badge and established what is required to earn the badge. Participants were tested on the PACER, pushups, curl-ups, and flexibility (sit and reach). The height, weight, and waist circumference of each scout was gathered in a private room. The resting blood pressure and a blood lipid finger prick were also taken. As the participants left the first merit badge class, they were given a Digiwalker CW600 pedometer to wear for 6 consecutive days (starting on the Sunday following the class), excluding showering, swimming, or another activity that could damage the pedometer if worn. At the completion of the 6 days, participants met again at the location of the merit badge class to turn in their pedometers to the researcher. Also, after the first class, the participants started working on the completion of their individual Personal Fitness merit badges or went about their normal lives if they were in the control group. The participants did not meet with the research team again until the Personal Fitness merit badge was completed 12-weeks later. At the completion of the 12-weeks, the scouts returned for the last class where they were again tested and measured. If they have completed the merit badge requirements, the principal investigator signed off that the Personal Fitness merit badge had been earned. Again, as the participants left, they were given a Digiwalker CW600 to wear for 6 more days (beginning on the Sunday after the class). Once the pedometers had been returned, the intervention was completed.

Data Analysis

Normal distributions were examined using histograms and the Shapiro-Wilk test. Outliers were identified using box-plots and z-scores. Because of the small sample size, a nonparametric Wilcoxon Signed Rank test was employed to examine the median

differences from pretest to posttest on all dependent variables. The first dependent variable was a Metabolic Syndrome score (MetS), which is a clustering of biomarkers and has been associated with adolescent fatness (Eisenmann, 2007). The MetS score was calculated by converting each cardio-metabolic health marker (i.e., HDL cholesterol, triglycerides, blood glucose, mean arterial pressure, and waist circumference) into a z-score. Because HDL cholesterol is inversely related to health risk, the z-score for this parameter was multiplied by -1. The MetS score used for analysis was the sum of z-scores. The second dependent variable was aerobic capacity as measured using the PACER test and a linear regression equation to estimate VO2 peak, which is currently used by FITNESSGRAM testing battery. The last dependent variable was BMI. All analyses had an initial alpha level of, $p \leq 0.05$ and were carried out using the SPSS v21.0 statistical software package (Armonk, NY, USA).

RESULTS

The related-samples Wilcoxon signed rank test showed that the median of differences between VO2 peak pretest and posttest scores were statistically significant (p=0.004). However, it also showed that the differences between the Pre-MetS and Post-MetS scores were not statistically significant (p=0.917). The differences of average steps taken per day in the pretest and posttest were not statistically significant (p=0.317). Additionally, the differences of pretest BMI to posttest BMI scores were not statistically significant (p=0.419). Data were also collected from convenience sample of 6 control participants with the mean age 15.8 (SD=1.83); however, the sample was not large enough to perform comparative statistics. The related-samples Wilcoxon signed rank test showed that the median of differences between VO2 peak pretest and posttest scores for the control group were not statistically significant (p=1.000*)*. The difference of Pre-BMI and Post-BMI for the control group were not statistically significant (p=.102). Lastly, the difference of Pre-MetS and Post-MetS for the control group were not statistically significant (p=.600). Descriptive statistics for both the experimental and control groups are found in Table 1. The median differences from pretest to posttest for all dependent variables are presented in Figures 1-3.

Table 1: Descriptive Statistics for Experimental and Control Groups

	Experimental *N*	Mean	Standard Deviation	Control *N*	Mean	Standard Deviation
Pre-VO2	21	44.88	4.92	6	59.67	28.77
Post-VO2	14	49.55	4.97	4	63.25	17.89
Pre-BMI	21	18.67	3.31	6	18.83	1.60
Post-BMI	14	19.02	3.43	6	19.43	1.58
Pre-MetS	19	-.526	3.58	6	1.90	2.31
Post-MetS	15	-1.14	3.14	6	1.62	2.70

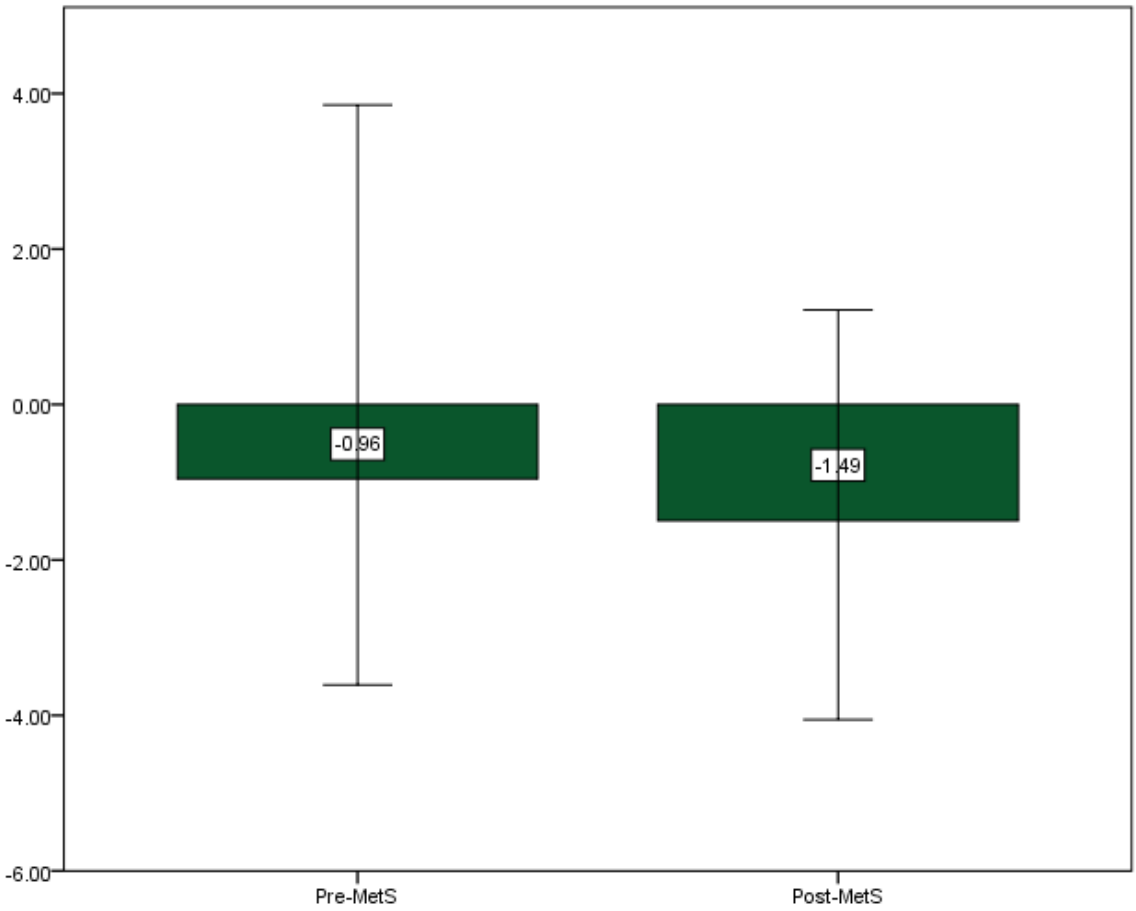

Figure 1: Median Difference Between Pre-MetS and Post-MetS

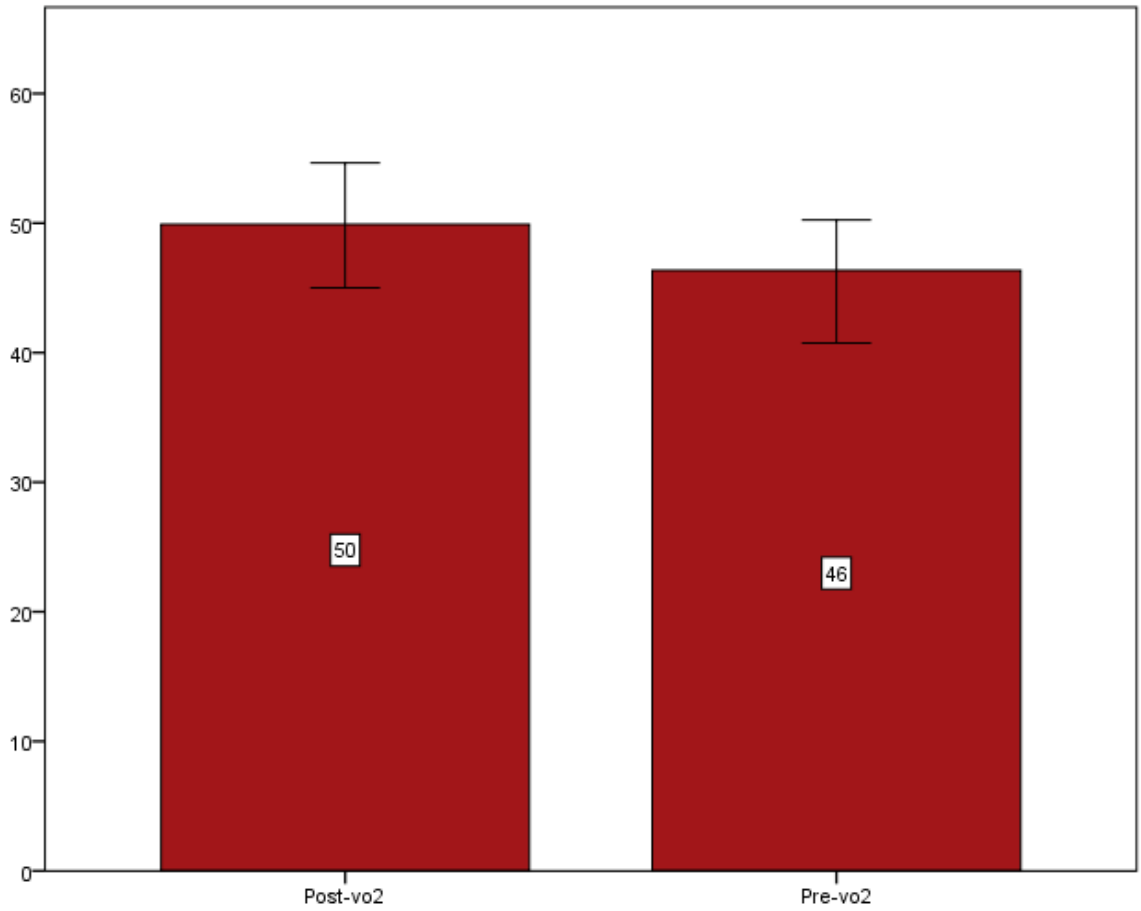

Figure 2: Median Difference Between Pre-VO2 Peak and Post-VO2 Peak; Statistically significant p>.0004

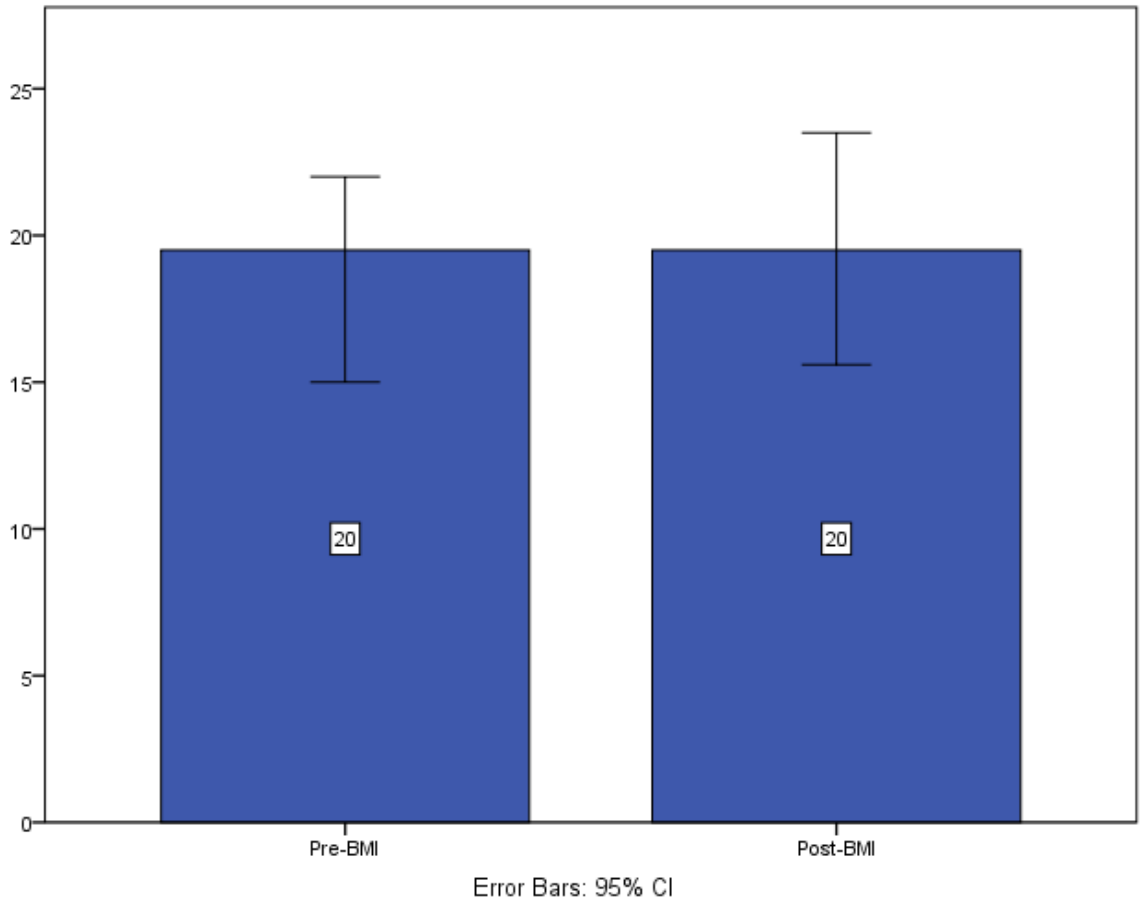

Figure 3: Median Difference Between Pre-BMI and Post-BMI

DISCUSSION

The purpose of this research study was to evaluate the effects of the Personal Fitness merit badge system on physical activity, health-related fitness, and cardio-metabolic blood profiles in Boy Scouts aged 11-17 years. The results showed that only VO2 peak of health-related fitness saw significant change from the beginning of the 3-month merit badge intervention period to the end of the intervention period (see Figure 2).

This is an important finding as the professionals at the National Association for Sport and Physical Education (NASPE) have said that the VO2 peak is the most important element of health-related fitness because of its positive link to cardio-metabolic health (NASPE, 2011).

One reason for this significant change could be because the Physical Fitness merit badge focuses on running as part of the scouts personal fitness plan. Scouts are asked to set specific goals to improve their running times and many times throughout the 12 weeks, they are asked to check for improvement.

Eisemann, Laurson, and Welk (2011) determined that the average or 50^{th} percentile VO2 peak for an adolescent boy ranges from 42-46 mL/kg/min depending on age. When the participants began the merit badge, they too had an average adolescent VO2 peak; however, by merit badges' end, they had increased their VO2 peak closer to the 75^{th} percentile of adolescent boys – 49.9 mL/kg/min.

It is also recognized that the change found in VO2 peak from the pretest to the posttest could have simply been from the participants having natural maturation growth.

Thus, the results were not due to the merit badge, but to the participants getting more physically mature. However, that much maturation in 12 weeks is not as likely. They also could have taken the PACER test in physical education class at school, thus enabling them to better know what to expect from the test and better perform the test because of greater opportunities to practice.

The results showed that there was not a significant change between the pre- and post-test for MetS scores. One possible reason for this could be because the intervention period of 3 months was not long enough. Another study similar to this one also found that there was no significant change in the cardio-metabolic profiles of its intervention participants and it too was 12-weeks long (Harrington et al., 2015). Some studies have shown that physical activity interventions like the merit badge have improved metabolic profiles; however, they were all longer than 3 months (Beavers, Beavers, Lyles, & Nicklas, 2012; Cui, Trusedale, Bradshaw, Cai, & Stevens, 2015; Kujala et al., 2011). If we were to see changes in metabolic profiles, the merit badge would have to be closer to a year in length, which is probably feasible for the Boy Scouts of America.

Similar to the lack of change in the MetS score, there was no significant difference in BMI from pretest to posttest. Again, one reason could be because the intervention period was not long enough. The MSPAN study, which had a total of 33 months (21 months longer than this study), found significant change in BMI over time (Sallis et al., 2003), providing evidence that a longer physical activity intervention can have an effect on BMI. Another reason for the lack of change in BMI could be because it has been found that BMI changes are stronger in overweight populations (Berkey, Rockett, Gillman, &

Colditz, 2003) and this cohort of scouts had an average BMI of 19, falling in the CDC healthy weight category (CDC, 2015).

Another reason for the lack of changes in MetS scores and BMI could be because the merit badge has a focus on physical activity, but there is little emphasis placed upon nutrition. What the scouts eat can be just as important as the activity they are participating in on a daily basis.

All scouts should be encouraged to participate and earn the Personal Fitness merit badge even if they are not striving to earn their Eagle Scout award. The merit badge could also be used in schools as a project to be completed in a physical education class. It even has the potential to be used by pediatricians as a way to improve cardiovascular fitness of adolescent patients who are showing signs of increased disease risk. In athletics, a coach could assign his athletes to use the merit badge as an offseason conditioning program to improve aerobic capacity.

Many of the studies presented earlier also reported limited success when it came to health-related results. It appears that many interventions like this one will see one or two significant areas of change and other areas of little or no change. It is recommended that researchers in the future create or adapt interventions that follow the 10 guidelines presented by Alberga et al. (2013) as closely as possible. The list below marks the Alberga guidelines that were met by the Personal Fitness merit badge with a check and the guidelines that were not met with an empty circle. Perhaps a reason for the limited amount of change from the merit badge is that not more of the recommendations were met.

- ○ Physical activity setting is important

- Choice of trainer matters
- Physical activity should be varied and fun
- ✓ Parents-guardians should be included
- Individual physical and psychosocial characteristics should be accounted for
- ✓ Realistic goals should be set
- ✓ Regular reminders are important
- Multidisciplinary approach should be used
- Barriers should be identified early along with plans to overcome them
- ✓ Participants should be told what's in it for them

It is my recommendation that the Personal Fitness merit badge be adapted to address all of these recommendations so that more change beyond the VO2 peak occurs.

Limitations

The power analysis revealed that at least 15 participants were required to be a part of the experimental group and at least 15 to be a part of the control group. Only 6 participants were in the control group, therefore the power was not strong enough to compare groups. The statistical analyses were then changed from the stronger three-way 2 x 2 x 2 mixed design ANOVA test to comparing the medians using the asymptomatic Wilcoxon signed rank test. Due to the timing of the study, no follow-ups occurred after the 12-week intervention. The control group consisted of a biased sample as they chose not to earn the Physical Fitness merit badge. Lastly, the participants failed to wear the pedometers enough to get an accurate reading on physical activity levels.

Future Research Directions

It is recommended that the study be repeated with the appropriate amount of participants in both the experimental and the control groups. To do this, it is recommended that researchers go to as many individual scout troops as possible, instead of trying to organize through the scouting districts. This will take more time, but I believe it will produce better results. As for finding control participants, it is recommended that researchers use schools as way to recruit participants. To measure how well each scout troop participated in the merit badge, surveys could be given to scout leaders and parents. Potential questions could be, how often did you talk about the merit badge? Did you examine and help the scout create their work-out plan? Was the merit badge talked about weekly? Biweekly? Monthly? It would be of interest to perform follow-ups anywhere from 3 to 12 months after the completion of the merit badge to see if the changes were more permanent or temporary. Considerations should be made to adapt the merit badge to align more fully with an effective physical activity intervention as presented by Alberga et al. (2013). Perhaps the merit badge intervention period should be increased. The merit badge could also be studied in a physical education class where both boys and girls are applying the principles of the badge.

CONCLUSION

In this study, physical activity as measured by the pedometer did not have a significant increase over time, thus the null hypothesis is retained. Cardiovascular endurance as measured through the PACER test and configured to find a VO2 peak saw a significant increase over time, thus the null hypothesis is rejected. BMI did not have a significant decrease, thus the null hypothesis is retained. The MetS score did not have significant change, thus the null hypothesis is retained. The Physical Fitness merit badge did have an impact on cardiovascular endurance of the participants who earned the merit badge. While improvements in other areas of health-related fitness may be lacking, the idea that VO2 peak was significantly improved shows that the merit badge can and should be used as a physical activity intervention. If desired, the Boy Scouts of America could work to improve the merit badge to include other aspects such as physical activity, cardio-metabolic profiles, and BMI.

REFERENCES

Alberga, A. S., Medd, E. R., Adamo, K. B., Goldfield, G. S., Prud'homme, D., Kenny, G., & Sigal, R. (2013). Top 10 practical lessons learned from physical activity interventions in overweight and obese children and adolescents. *NRC Research Press*, *38*, 249-258.

Andersen, L. B., & Haraldsdotter, J. (1993). Tracking of cardiovascular disease risk factors including maximal oxygen uptake and physical activity from late teenage to adulthood: An 8-year follow-up study. *Journal of Internal Medicine, 243*, 309-315.

Annesi, J. J., Westcott, W. L., Faigenbaum, A. D., & Unruh, J. L. (2005). Effects of a 12-week physical activity protocol delivered by YMCA after-school counselors (youth fit for life) on fitness and self-efficacy changes in 5–12-year-old boys and girls. *Research Quarterly for Exercise and Sport*, *76*(4). http://dx.doi.org/10.1080/02701367.2005.10599320).

Beavers, D. P., Beavers, K. M., Lyles, M. F., & Nicklas, B. J. (2012). Caridometabolic risk after weight loss and subsequent weight regain in overweight and obese postmenopausal women. *The Journals of Gerontology*, *68*, 691-698.

Berkey, C. S., Rockett, H. R. H., Gillman, M. W., & Colditz, G. A. (2003). One-year changes in activity and in inactivity among 10- to 15-year-old boys and girls: Relationship to change in body mass index. *Pediatrics, 111,* 836-843.

Boy Scouts of America. (2015). About the BSA. Retrieved August 31, 2015, from http://www.scouting.org/About.aspx

Center for Disease Control and Prevention. (2015). Body mass index-for-age percentiles: Boys, 2 to 20 years [Table]. Retrieved from http://www.cdc.gov/healthyweight/assessing/bmi/childrens_bmi/about_childrens_bmi.html

Centers for Disease Control and Prevention. (2013). Youth risk behavior survey. *Center for Disease and Control*. Retrieved from http://www.cdc.gov/yrbs

Cui, Z., Truesdale, K. P., Bradshaw, P. T., Cai, J., & Stevens, J. (2015). Three-year weight change and cardiometabolic risk factors in obese and normal weight adults who are metabolically healthy: The atherosclerosis risk in communities study. *The Journal of Obesity*. http://dx.doi.org/10.1038/ijo.2015.56

Desmond, S., Price, J., Lock, R., Smith, D., & Stewart, P. (1990). Urban black and white adolescents' physical fitness status and perceptions of exercise. *Journal of School Health, 60*, 220-226.

Dunstan, D. W., Howard, B., Healy, G. N., & Owen, N. (2012). Too much sitting – A health hazard. *Diabetes Research and Clinical Practice*, *97*, 368-376. http://dx.doi.org/10.1016/j.diabres.2012.05.020

Eisenmann, J. C. (2007). Aerobic fitness, fatness and the metabolic syndrome in children and adolescents. *Acta Paediatrica*, *96*, 1723-1729.

Eisenmann,, J. C., Laurson, K. R., & Welk, G. J. (2011). Aerobic fitness percentiles of U.S. adolecents. *American Journal of Preventive Medicine*, *41*, 106-110.

Eisenmann, J. C., Welk, G. J., Ihmels, M., & Dollman, J. (2007). Fatness, fitness, and cardiovascular disease risk factors in children and adolescents. *American College of Sports Medicine*, *39*, 1251-1256.

Harrington, D. M., Champagne, C. M., Broyles, S. T., Johnson, W. D., Tudor-Locke, C., & Katzmarzyk, P. T. (2015). Cardiometabolic risk factor response to a lifestyle intervention: A randomized trial. *Metabolic Syndrome and Related Disorders*, *13*(3), 125-131. http://dx.doi.org/10.1089/met.2014.0112

Hoefer, W. R., McKenzie, T. L., Sallis, J. F., Marshall, S. J., & Conway, T. L. (2001). Parental provision of transportation for adolescent physical activity. *American Journal of Preventive Medicine*, *21*(1), 48-51. http://dx.doi.org/10.1016/S0749-3797(01)00314-2

Jago, R., & Baranowski, T. (2004). Non-curricular approaches for increasing physical activity in youth: A review. *Preventive Medicine*, *39*(1), 157-163.

Jago, R., Baranowski, T., Baranowski, J. C., Thompson, D., Cullen, K. W., Watson, K., & Liu, Y. (2006). Fit for life boy scout badge: Outcome evaluation of a troop and internet intervention. *Preventive Medicine*, *42*(3), 181-187.

Jago, R., Watson, K., Baranowski, T., Zakeri, I., Yoo, S., Baranowski, J., & Conry, K. (2006). Pedometer reliability, validity and daily activity targets among 10- to 15-year-old boys. *Journal of Sports Sciences*, *24*(3), 241-311.

Katzmaryk, P. T., Persusse, L., Malina, R. M., Bergeron, J., Despres, J., & Bouchard, C. (2001). Stability of indicators of the metabolic syndrome from childhood and adolescence to young adulthood: The quebec family study. *Journal of Clinical Epidemiology*, *54*, 190-195.

Kujala, U. M., Jokelaninen, J., Oksa, H., Saaristo, T., Rautio, N., Moilanen, L., . . . Keinanen-Kiukaannemi, S. (2011). Increase in physical activity and cardiometabolic risk profile change during lifestyle intervention in primary

healthcare: 1-year follow-up study among individuals at high risk for type 2 diabetes. *BMJ Open*, *1*(2). http://dx.doi.org/10.1136/bmjopen-2011-000292

Latif, H., Watson, K., Nguyen, N., Thompson, D., Baranowski, J. C., Jago, R., . . . Baranowski, T. (2011). Effects of goal setting on dietary and physical activity changes in the boy scouts badge project. *Health Education & Behavior*, *38*(5), 521-529.

McKenzie, T. L. (2001). Promoting physical activity in youth: Focus on middle school environments. *QUEST*, *53*, 326-334.

McKenzie, T. L., Marshall, S. J., Sallis, J. F., & Conway, T. L. (2000). Leisure-time physical activity in school environments: An observational study using SOPLAY. *Preventive Medicine*, *30*(1), 70-77. http://dx.doi.org/10.1006/pmed.1999.0591

McKenzie, T. L., Marshall, S. J., Sallis, J. F., & Conway, T. L. (2000). Student activity levels, lesson context, and teacher behavior during middle school physical education. *Research Quarterly for Exercise and Sport*, *71*(3), 249-259. http://dx.doi.org/10.1080/02701367.2000.10608905

McKenzie, T. L., Prochaska, J. J., Sallis, J. F., & Lamaster, K. J. (2004). Coeducational and single-sex physical education in middle schools: Impact on physical activity. *Research Quarterly for Exercise and Sport*, *75*(4), 446-449. http://dx.doi.org/10.1080/02701367.2004.10609179

Menke, A., Rust, K. F., Fradkin, J., Cheng, Y. J., & Cowie, C. C. (2014). Associations between trends in race/ethnicity, aging and body mass index with diabetes prevalence in the united states. *Annal of Internal Medicine*, *161*(5), 328-335.

Moody, J. S., Prochaska, J. J., Sallis, J. F., McKenzie, T. L., Brown, M., & Conway, T. L. (2004). Viability of parks and recreation centers as sites for youth physical activity promotion. *Health Promotion Practice*, *5*(4), 438-443. http://dx.doi.org/10.1177/1524839903258222

National for Sport and Physical Education. (2011). *Physical education for lifelong fitness* (3rd ed.). Champaign, IL: Human Kinetics.

National, Heart, Lung, and Blood Institute. (2004). Blood pressure tables for children and adolescents. Retrieved September 18, 2015, from http://www.nhlbi.nih.gov/health-pro/guidelines/current/hypertension-pediatric-jnc-4/blood-pressure-tables

Riley, M., & Bluhm, B. (2012). High blood pressure in children and adolescents. *American Family Physician*, *85*(7), 693-700.

Sallis, J. F., Conway, T. L., Prochaska, J. J., McKenzie, T. L., Marshall, S. J., & Brown, M. (2001). The association of school environments with youth physical activity. *American Journal of Public Health, 91*(4), 618-620.

Sallis, J. F., McKenzie, T. L., Conway, T. L., Elder, J. P., Prochaska, J. J., Brown, M., . . . Alcaraz, J. E. (2003). Environmental interventions for eating and physical activity: A randomized controlled trial in middle schools. *American Journal of Preventive Medicine*, *24*(3), 209-2017.

Sallis, J. F., Patrick, K., Frank, E., Pratt, M., Wechsler, H., & Galuska, D. A. (2000). Interventions in health care settings to promote healthful eating and physical activity in children and adolescents. *Preventive Medicine*, *31*(2), S112-S120.

Segar, M. L., Eccles, J. S., & Richardson, C. R. (2008). Type of physical activity goal influence participation in health midlife women. *Women's Health Issues*, *18*, 281-291.

Sparkpe. (2015). Middle school PE program. Retrieved from http://www.sparkpe.org/physical-education/middle-school/

Strelow, J. S., Larsen, J. S., Sallis, J. F., Conway, T. L., Powers, H. S., & McKenzie, T. L. (2002). Factors influencing the performance of volunteers who provide physical activity in middle schools. *Journal of School Health*, *72*(4), 147-151.

Sun, C., Pezic, A., Tikellis, G., Ponsonby, A., Wake, M., & Carlin, J. (2013). Effects of school-based interventions for direct delivery of physical activity on fitness and cardiometabolic markers in children and adolescents: A systematic review of randomized controlled trials. *Obesity Reviews*, *14*(10), 818-838.

Vaisto, J., Eloranta, A.-M., Viitasalo, A., Tompuri, T., Lintu, N., Karjalainen, P., . . . Lakka, T. A. (2014). Physical activity and sedentary behaviour in relation to cardiometabolic risk in children: Cross-sectional findings from the physical activity and nutrition in children (PANIC) study. *International Journal of Behavioral Nutrition and Physical Activiy, 11*, 55. doi: 10.1186/1479-5868-11-55

Zhang, X., Geiss, L. S., Caspersen, C. J., Cheng, Y. J., Engelau, M. M., Johnson, J. A., . . . Gregg, E. W. (2010). Physical activity levels and differences in the prevalence of diabetes between the united states and canada. *Preventive Medicine, 50*, 241-245.